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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

ED 062405

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

POWER LAWN MOWER ASSEMBLER (agric. equip.) 6-94.352

B-405 or S-141

TM 001 523

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U. S. Employment Service in
Cooperation with
Wisconsin State Employment Service

U. S. DEPARTMENT OF LABOR
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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR POWER LAWN MOWER ASSEMBLER 6-94.352

B-405 or S-141

Summary

The General Aptitude Test Battery, B-1002A, was administered to a sample of 52 male applicants who were later employed as Power Lawn Mower Assembler 6-94.352 by the Jacobsen Manufacturing Company, Racine, Wisconsin. The criterion consisted of broad category supervisory ratings. On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes G-Intelligence, S-Spatial Aptitude, P-Form Perception, and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Power Lawn Mower Assembler 6-94.352 - B-405 or S-141

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Power Lawn Mower Assembler 6-94.352.

TABLE I
Minimum Acceptable Scores on B-1001 and B-1002 for B-405 or S-141

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1-H CB-1-I CB-1-J	105	G	Part 3 Part 4 Part 6	100
S	CB-1-F CB-1-H	90	S	Part 3	85
P	CB-1-A CB-1-L	85	P	Part 5 Part 7	85
M	CB-1-M CB-1-N	80	M	Part 9 Part 10	80

Effectiveness of Norms

The data in Table IV indicate that 11 of the 18 poor workers, or 61 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 61 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 31 of the 38 workers who made qualifying test scores, or 82 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Power Lawn Mower Assembler 6-94.352.

II. Sample

During the period November 1956 to February 1958, the GATB, B-1002A, was administered to 54 male applicants who were later employed as Power Lawn Mower Assembler 6-94.352 by the Jacobsen Manufacturing Company, Rachine, Wisconsin. The men were hired without regard to test results and worked for a varying period of time in an unskilled labor pool before being transferred to the occupation of Power Lawn Mower Assembler. Two of the 54 men were eliminated from the sample because the raters were unable to rate them satisfactorily without the influence of personality factors - one was considered to be lazy and the other a trouble maker.

There was no minimum age, education, or experience requirements. Hiring was done on the basis of a personal interview and a check of references. The training period for this job was considered to be one month. All the workers in the sample had at least two months of experience before they were rated.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations (corrected for broad categories) with the criterion for age, education, and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion (c^r) for Age, Education, and Experience

Power Lawn Mower Assembler 6-94.352
N = 52

	M	σ	Range	c^r
Age (years)	29.3	7.5	19-46	.028
Education (years)	11.4	1.8	8-16	.004
Experience (months)	6.2	1.3	2-10	.096

There are no significant correlations between age, education, or experience and the criterion. The data in Table II indicate that the sample is suitable for test development purposes with respect to age, education, and experience.

III. Job Description

Job Title: Power Lawn Mower Assembler 6-94.352

Job Summary: Works as a member of a progressive assembly line crew performing any of a variety of assembly operations in the fabrication of gasoline engines and powered lawn mowers. Works from oral instructions assembling pre-inspected parts in prescribed sequence. Assembles power units by fitting together connecting rod, crankshaft, bearings, pistons, and rings; inserts rod, piston and shaft assembly into crankcase; attaches cylinder to crankcase. Attaches carburetor, magneto, wiring, muffler, governor, and other parts to power unit; aligns parts; positions and cements gaskets; and fastens parts together with screws, nuts, bolts and washers. Assembles rotary mower blades and reel mechanisms for mowers and drive unit for power propelled mowers. Attaches power unit to deck or body of mower and bolts securely. Fastens on braces and protective guard plates. Attaches mowing head, gas tank, gas line, spark plug, and throttle. Manipulates assembled parts to insure freedom of action. Visually checks for defective parts during assembly. Starts engine, checks performance, and makes any necessary adjustments for proper operation. Uses a variety of hand and power tools such as riveter, screw driver, ratchet, regular and socket wrenches, pliers, and hammer. May place work in bench jig of fixture for assembling. Applies special lubricants or cleaning fluid during assembly. May use arbor press to press shafts, crankcase parts, gears or pulleys together. Notifies foreman of any assembly difficulties.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to the sample group.

V. Criterion

An analysis was made of the several criteria available for the sample of Power Lawn Mower Assembler. These criteria consisted of: (1) first and second rank order ratings made by the day shift foreman for 45 of the workers in the sample; (2) first and second rank order ratings made by the assistant day shift foreman for 39 of the 45 workers who had been rated by the day shift foreman; (3) first and second rank order ratings made by the night shift foreman for 7 workers who were not included in the group rated by either of the day shift foremen. In addition, each foreman made two sets of broad category ratings (Above Average, Average, and Below Average) for each group of workers. The correlation obtained between the first and second rank order ratings made by the day shift foreman was .789. A correlation of .587 was obtained between the first and second rank order ratings of the assistant day shift foreman. The seven workers rated by the night shift foreman were placed in identical rank order in each instance. Since the assistant day shift foreman showed a relatively low consistency between his two sets of ratings, it was decided not to use his ratings for validation purposes.

The final criterion, which was used for validation purposes, consisted of ratings in three broad categories made by the day shift foreman and the night shift foreman as follows:

(1) Forty-five workers were rated by the day shift foreman; initial and reratings were made with a three-week interval between the two sets of ratings.

(2) Seven workers were rated by the night shift foreman. These workers were different from the forty-five rated by the day shift foreman. Initial and reratings were made with a three-week interval between the two sets of ratings.

Ratings for the forty-five workers rated by the day shift foreman and the seven workers rated by the night shift foreman were combined into one set of broad category ratings by merging the groups in the respective categories of Above Average, Average, and Below Average. This was done separately for the first and second sets of ratings. The Pearson product-moment correlation, corrected for both variables expressed in broad categories, obtained between the first and second sets of ratings for the sample of 52 workers was .859 which indicates a high degree of reliability between the two ratings. The most reliable criterion would be a combination of these two. Therefore, for the final criterion, the first and second ratings for each worker were combined.

Category	N	Numerical Score
AA	10	64
AB	7	57
BB	17	50
BC	8	44
CC	10	36

VI. Statistical and Qualitative Analyses

A. Statistical Analysis:

Table III shows the means, standard deviations, and Pearson product-moment correlations (corrected for broad categories) with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion (c^r) for the Aptitudes of the GATB

Power Lawn Mower Assembler 6-94.352
N = 52

Aptitudes	M	σ	c^r
G-Intelligence	109.2#	12.9	.389**
V-Verbal Aptitude	102.6	12.1	.122
N-Numerical Aptitude	108.0#	11.8	.023
S-Spatial Aptitude	110.3#	18.2	.368**
P-Form Perception	104.9	16.7	.352*
Q-Clerical Perception	102.8	12.4	.375**
K-Motor Coordination	102.4	16.0	.062
F-Finger Dexterity	99.1	18.4	.221
M-Manual Dexterity	107.5#	14.4	.231

**Significant at the .01 level
*Significant at the .05 level
#Highest mean scores

B. Qualitative Analysis:

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Spatial Aptitude (S) - required to visualize three-dimensional relationships in assemblying and fitting parts of the mower together.

Form Perception (P) - required to make visual inspection of parts to be assembled and to detect defective parts.

Finger Dexterity (F) and Manual Dexterity (M) - required to move fingers and hands skillfully in putting the parts together and in fastening the screws, nuts, bolts, and washers using hand and power tools.

C. Selection of Test Norms:

Based on the quantitative and qualitative evidence cited above, Aptitudes G, S, P, and M warranted further consideration for inclusion in the test norms. The evidence for each of these aptitudes is indicated below.

Aptitude	High Mean Score	Significant Correlation with the Criterion	Importance Indicated by Qualitative Analysis
G	X	X	
S	X	X	X
P		X	X
M	X		X

Although Aptitude F appeared to be important on the basis of the job analysis data, Aptitude N showed a relatively high mean score, and Aptitude Q showed significant correlation with the criterion at the .01 level, these aptitudes were not considered further for inclusion in the norms because there was not sufficient qualitative or quantitative evidence of significance.

Various combinations of Aptitudes G, S, P, and M, with appropriate cutting scores were selected as trial norms. The relationship between each set of trial norms and the criterion (dichotomized as indicated in Section VII was determined.

A comparison of the results showed that norms consisting of G-100, S-85, P-85, and M-80 for B-1002 and equivalent norms of G-105, S-90, P-85, and M-80 for B-1001 had the best selective efficiency.

In test development studies an attempt is made to develop a set of norms such that the cutting score for each aptitude included in the norms will be set at a five-point score level close to one standard deviation below the aptitude mean of the experimental sample. Adjustments of cutting scores from one standard deviation below the mean are made to effect better selective efficiency of the norms. In this study the aptitude cutting scores are each within 15 points of one standard deviation below the aptitude mean of the sample.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized with those workers rated either BC or CC placed in the low criterion group; all others were placed in the high criterion group. This resulted in 18 of the 52 workers, or 35 percent of the sample, being placed in the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes G, S, P, and M with critical scores of 100, 85, 85, and 80 respectively, and the dichotomized criterion for Power Lawn Mower Assembler 6-94.352. Workers in the high criterion group have been designated as "good workers," and those in the low criterion group as "poor workers."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes G, S, P, and M with Critical Scores of 100, 85, 85, and 80 Respectively, and the Criterion for Power Lawn Mower Assembler 6-94.352

N = 52

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	3	31	34
Poor Workers	11	7	18
Total	14	38	52

$r_{tet} = .81$ $\quad X^2 = 13.805$

$\sigma r_{tet} = .24$ $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes G, S, P, and M, with minimum scores of 100, 85, 85, and 80 respectively, are recommended as B-1002 norms for the occupation of Power Lawn Mower Assembler 6-94.352. The equivalent B-1001 norms consist of G-105, S-90, P-85, and M-80.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include four aptitudes, only those occupational aptitude patterns which include three of those four aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. Two of the existing 23 occupational aptitude patterns meet these criteria for this study. These occupational aptitude patterns and their B-1002 norms are OAP-8, which consists of G-95, S-95 and M-85 and OAP-13, which consists of S-75, P-75 and M-75. The selective efficiency of each of these OAP's for this sample was determined by means of the tetrachoric correlation technique. No significant relationship was obtained between OAP-8, OAP-13, and the dichotomized criterion. Therefore, none of the existing 23 occupational aptitude patterns is recommended for the occupation of Power-Lawn Mower Assembler 6-94.352. However, the data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.